Remarks

Claim 1 was pending in the application. In the instant Amendment, claim 1 has been amended to recite that the steel sheet contains, by mass%, 1.3 to 3.0% of Si, and that in the aqueous solution both the HCl and Fe concentrations are mass% and the dipping time and HCl concentration satisfy that the HCl concentration (mass %) x dipping time (sec) is 280 to 520. Support for the amendment of Si content is found, for example, in Table 1 of the specification, which discloses examples having 1.3% of Si (*see* steel nos. 5, 6, 13, and 14). Support for the amendment that HCl concentration and dipping time satisfy HCl concentration (mass %) x dipping time (sec) is at least 273 is found, for example, in Table 2 of the specification, which discloses 273 as the value for HCl concentration (%) x dipping time(s) (*see* Table 2, inventive pickling condition C). Claim 1 has also been amended to delete the recitation that the dipping time is 40 sec or more. Support for the amendment is found, for example, in Table 2 of the specification, which discloses inventive examples having dipping time less than 40 sec (*see* Table 2, inventive pickling conditions A-C and E). The recitation that HCl and Fe concentrations are mass% was in the canceled claim 7. Claim 1 has also been amended to remove the recitation of HNO_3 in the pickling solution, which recitation corresponds to subject matter of canceled claim 8. Claim 1 has also been amended to correct grammatical or editorial errors and to make the claim language clearer.

New claim 9 corresponding to canceled claim 8 has been added.

New claim 10 recites that the dipping time is such that the HCl concentration (mass %) x dipping time (sec) is 280 to 520. Support for the claim is found in Table 2 of the specification, which discloses 280 as the value for HCl concentration (%) x dipping time(s) (*see* Table 2, inventive pickling condition B).

New claim 11 recites that the dipping time is 40 sec or more, which was recited in claim 1 prior to the present amendment.

Accordingly, no new matter has been introduced by the present amendment. Entry of the foregoing amendment and consideration of the following remarks are respectfully requested. Upon entry of the instant Amendment, claims 1 and 9-11 will be pending in the application.

Claim rejection under 35 U.S.C. §103

Claim 1 is rejected under 35 U.S.C. §103(a) as being unpatentable over the English machine translation of JP 2003-155541 ("JP '541") for the reasons set forth on pages 2-5 of the Office Action.

While not acquiescing to Examiner's rejection, claim 1 has been amended to recite that the steel sheet contains, by mass%, 1.3 to 3.0% of Si and that the dipping time is such that the HCl concentration (mass %) x dipping time (sec) is 273 to 520.

The present invention provides a hot rolled steel sheet raised in Si content and excellent in chemical convertibility, in which a conversion coating is formed homogeneously over the entire surface of the steel sheet during priming. As discussed in the present application, if a steel sheet contains a high amount of Si, the amount of Si concentration in oxides remain on the steel sheet surface after hot rolling will increase. It is believed that at locations with residual high Si-content oxides, bald spots or locations where no conversion coating is formed are observed due to the delay in dissolution of Fe ions and the delay in the reaction for forming converted crystal grains at the time of chemical conversion. The present inventors have discovered that in addition to the steel sheet containing, by mass%, 0.03 to 0.15% of C, 1.3 to 3.0% of Si, 0.5 to 3.0% of Mn, 0.07% or less of P, 0.01% or less of S, 0.015 to 0.1% of Al, 0.001 to 0.008% of N, and optionally containing one or more of the Ti: 0.02 to 0.3%, Nb: 0.01 to 0.5%, Ni: 0.1 to 2.0%, B: 0.0002 to 0.006% and Ca: 0.0005 to 0.005%; and being free from Cu and Mo, if the steel sheet also contains recited Si and Mn concentrations in the oxides on the steel sheet surface (*i.e.*, having a Si concentration of 3.5 mass% or less and a Mn concentration of 3.5 mass% or less) and average number of pits and average roughness in the respective recited range, there is no delay in dissolution of Fe ions in the chemical conversion, thereby preventing the generation of bald spots on the surface of the steel sheet while improving the chemical convertibility of the steel sheet.

Applicants have also discovered that in order to produce the claimed steel sheet and to prevent bald spots from occurring, it is required that the following conditions are met during pickling: dipping the steel sheet in an aqueous solution containing, in mass%, a HCl concentration of 7 to 15 %, an Fe ion concentration of 4 to 12% and a balance of metal ions other than Fe and impurities, at a solution temperature of 80 to 98°C for a dipping time such that the HCl concentration (mass %) x dipping time (sec) is 273 to 520 (*see* p. 10, ll 15-22 and p. 11, ll 9-12 of the specification; and Tables 2 and 3).

For instance, if the HCl concentration is less than 7%, the Fe ion concentration is less than 4%, the solution temperature is less than 80°C, or the dipping time (sec) is not long

enough to provide the desired value of HCl concentration (mass %) x dipping time (sec), oxides with an Si concentration and Mn concentration exceeding 3.5% will remain at the steel sheet surface. If the HCl concentration is over 15%, the Fe ion concentration is over 12%, or the solution temperature is over 98°C, roughness of the steel sheet surface will occur due to pickling and the chemical convertibility will drop.

Table 3 provides experimental data to show that steel sheet having the recited composition and structure and produced by pickling conditions A-E exhibited no bald spot and rusting (*see* example nos. 1-6 and 11-26). In contrast, steel sheet having composition and/or structure outside the claimed range and/or produced by pickling conditions F-I exhibited bald spot and/or rusting (*see* example no. 7-10 and 27-33). The data show that both the steel composition and pickling conditions are critical in achieving the presently claimed invention. With respect to pickling conditions, comparative example no. 9 of Table 3 of the present application used an insufficient dipping time to give a HCl concentration (mass %) x dipping time (sec) of 210 (*see* Table 2, pickling condition H). Although the steel composition of example no. 9 corresponds to an inventive steel composition, *i.e.*, steel no. 2 of Table 1 of the present application, the use of pickling conditions outside the claimed conditions resulted in a Si concentration of the oxides exceeding 3.5%, and formation of bald spots and rusting on the surface of the steel sheet after chemical conversion.

JP '541 relates to a high strength hot rolled steel sheet having excellent corrosion resistance and stretch-flanging property, where the hot rolled steel sheet contains 0.03 to 0.10% of C, 0.05 to 1.2% of Si, 1.0 to 2.0% of Mn, ≤0.05% of P, ≤0.01% of S, ≤0.005% of N and 0.01 to 0.05% of Al, and optionally further contains one or both of Ti and Nb satisfying $-0.05 \leq \{Ti + (48/93) \times Nb - (48/12) \times C - (48/14) \times N - (48/32) \times S\} \leq 0.2$, and optionally further contains one or more of Cu, Ni and Ca, and the balance of Fe and unavoidable impurities. The thickness of an oxide film containing Fe_2SiO_4 on the surface is less than 5 μm, and the area ratio of a bainite-ferrite phase in the cross-sectional structure is more than 80%. In a method of this hot rolled steel sheet, the steel is heated to more than 1150°C, subjected to finish rolling as un-coiled so as to be completed at an Ar_3 point or higher, is subjected to high speed cooling to below 500°C, and then coiled at 300-500°C.

In contrast to the presently claimed invention, JP '541 teaches that it is necessary to reduce the Si content to less than 1.2% in order to produce a steel sheet with excellent corrosion resistance undergoing chemical conversion treatment. JP '541 teaches that a steel

sheet containing a high Si content is generally not desirable for securing corrosion resistance (*see* paragraph [0010] of JP '541). JP '541 also teaches that although Si is an effective element for securing strength without deteriorating frangeability, the excess amount of Si is not desirable to frangeability because the excess amount of Si will generate the polygonal ferrite phase which is typically not preferred and also it will be difficult to achieve corrosion resistance (*see* paragraph [0021] of JP '541). Therefore, a person skilled in the art would not have considered that it is desirable to contain more than 1.2% Si in the steel sheet, much less been led by JP '541 to seek the presently claimed hot rolled steel sheet which contains at least 1.3% Si.

JP '541 is only concerned with evaluating the amount of phosphate coating formed on the surface of the steel sheet (*see* paragraph [0044] of JP '541). JP '541 does not teach or suggest evaluating bald spots formed on the surface of the steel sheet. JP '541 neither recognizes the problem of bald spot generation on the steel sheet surface, nor teaches or suggests a solution to the problem. JP '541 teaches that its steel sheet is treated by dipping in 5% HCl solution at 80°C for around 30 seconds (*see* JP '541, at paragraph [0017]). The pickling treatment corresponds to an HCl concentration (mass %) x dipping time (sec) of 150, much lower than the claimed range. According to the present application, regardless of the steel composition, the pickling condition used in JP '541 would not have produced the presently claimed steel sheet. For instance, according to Table 3 of the specification, comparative example no. 9 had a dipping time to give a HCl concentration (mass %) x dipping time (sec) of 210 (*see* Table 2, pickling condition H), which resulted in a Si concentration of the oxides exceeding 3.5%, and formation of bald spots and rusting on the surface of the steel sheet after chemical conversion. Using pickling conditions where HCl concentration and HCl concentration (mass %) x dipping time (sec) are lower than those of comparative example no. 9, the steel sheets of JP '541 generate bald spots on the surface of the steel sheets. Applicants submit herewith a signed Declaration under 37 C.F.R. § 1.132 by Mr. Teruki Hayashida ("the Declaration"), a named co-inventor of the present application. The Declaration shows that the pickling conditions used to prepare the steel sheets in JP '541 are outside of the pickling conditions of the present invention and that the steel sheets of JP '541 contains bald spots. The Declaration also shows comparative examples disclosed in the present application. The data presented in the Declaration demonstrate the importance of the pickling conditions of the present invention in producing steel sheets free of bald spots.

Thus, JP '541, by using conventional pickling conditions, does not teach or suggest the claimed steel sheet.

Therefore, the compositions of the steel sheets of JP '541 and the presently claimed invention, as amended, do not overlap, and the processes of making the steel sheets of JP '541 and the presently claimed invention are not similar. One skilled in the art would not have obtained the hot rolled steel sheet of the present invention based on the disclosure of JP '541. Accordingly, the rejection of claim 1 under 35 U.S.C. §103(a) as obvious over JP '541 cannot stand, and should be withdrawn.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the present application is in condition for allowance. Early and favorable action by the Examiner is earnestly solicited. If the Examiner believes that issues may be resolved by a telephone interview, the Examiner is invited to telephone the undersigned at the number below.

Respectfully Submitted,

Date: March 25, 2010

By: Weining Wang

Weining Wang
Reg. No. 47,164
KENYON & KENYON LLP
One Broadway
New York, New York 10004
Telephone: (212) 425-7200
Fax: (212) 425-5288
CUSTOMER NO. 26646